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Brief report of an Artificial Rearing Method for

Paragus quadri-fasciatus Meigen

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The four-striped small syrphid fly, *Paragus quadri-fasciatus* Meigen, is one important kind of natural enemy of aphids. Since 1983 we have studied the utilization of this natural enemy. We selected perennial grasses (of two to three years life span), which host aphids. In the first year we planted the above-mentioned grasses and in the second year we raised the syrphid fly. Details of the method are described as follows:

The Motherwort aphid, Chuanjun grass aphid and an unknown aphid feeding on Artemisia (wormwood) were selected from the Tonghua region. These aphids are the dominant populations in this area. They are easy to rear and rapidly multiply. Among the three selected hosts of aphids, motherwort has a life span of 2 years. Chuanjun grass and wormwood grass are perennial grasses. They are the hosts of the aphids and start growing in the early spring and develop well. They can attract large amounts of aphids in a short period.

Boxes (20cm high, 20cm wide and 40 cm long) were prepared for growing grass. In the first spring motherwort, Chuanjun and wormwood grasses were seeded. The seeds of Chuanjun matured in July each year. The seeds of motherwort and wormwood matured in autumn every year. The boxes were put in pits and the grasses grew in the boxes. Each box can grow 10 Chuanjun grass, 15 motherwort, or 20 wormwood plants. After frost the boxes were taken out of the pits and covered by stems of maize, straw or similar materials in order to protect the grasses from frost damage. In March of the following year the boxes were moved to the greenhouse.

Wild motherwort, Chuanjun and wormwood grasses together with their aphids were collected in early September. The collected grasses were distributed over boxes with planted fresh grasses. The aphids moved to the fresh grasses, produced offspring, laid eggs and remained through the winter.

The method for maintaining aphids is similar to the one for keeping grasses. The aphids were fed separately the following year. The appearance of aphid wings is an indication that the density of the aphid population is too great. Parts of aphids can now be moved to the planted grasses without aphids.

When the grasses were grown to about 20cm height (motherwort), 15cm (Chuanjun), and 30cm (wormwood), 20 aphids each were placed on each grass plant. The plants with aphids were exposed to conditions of 20^{o}C, 60-75%RH in greenhouses. When the population of aphids was large enough, four-striped small syrphid flies were placed among the aphids. The suitable density of aphids was 30-50 individuals per cm^{2}. If the amount of aphids was less than the fly needed, the temperature in greenhouses could be raised to 25-28^{o}C for speeding up aphid growth and propagation.

When the plants of grasses had enough aphids, they could be removed from aphid rearing houses into the other greenhouses for inoculation with four-striped small syrphid flies.

The method was:

We made a net hood. The length and width of the hood were the same size as the grass growing wooden boxes. The suitable height of the hood was 10-15cm above the grass.

We put adults of the flies into the net hood, and then covered the hood on the aphid-grass plants. The better ratio of fly and aphid for inoculation was 1:100. The period of inoculation was 4 days. The temperature of inoculation was about 20^{o}C. We removed the net hood after 4-day inoculation.

We observed the fly eggs. The right ratio of eggs and aphids was 1:50 –100.

We added less water than before into the boxes when the last instar of larvae stopped eating and crawled abnormally. The soil moisture contentl was kept between 70-80% RH. Soil should be loose for ease of entering and pupating by fly larvae.

We cut down plants after all fly larvae had drilled into the soil.

We placed the boxes with the fly pupae at 23^{o}C condition for development.

We maintained moisture.

We put on the net hood again after 6 days in the conditions of 23^{o}C and suitable moisture.

We observed adults once a day at 10:00 am.

We hung strips with honey and water for adult nutritional complement after adult eclosion from pupa. The ratio of water and honey was 1:1.

The adults of four-striped small syrphid fly were better kept in 2-4^{o}C, which could roughly prolong adult life to 10 days. The suitable temperature for pupae was 0-4^{o}C.

We recommend caution in the proceedings of propagation:

1. Keep tools of propagation clean. The utensils should be washed every time before use by 0.3% disinfectan (Xinjiermie) and 0.3% Potassium Permanganate.

2. Maintain suitable temperature (20-25^{o}C) and humidity (70%RH).

3. Keep fresh air in the propagation rooms. The sunlight could not shine directly onto the grasses. Use as much as possible the same size of plants for aphid inoculating. Avoid rainfall or water washing away the aphids on the plants.

Well grown grasses, motherwort and artemisia (wormwood) of annual life span, and Chuanjun of two-year life span were selected in the beginning of September each year. Each square centimeter of grasses inoculated about 30 aphids, and then moved the collected wild flies from field onto the selected grasses carefully with writing brush. One fly needed 150 aphids. When the larvae of flies were not eaten and moved they should be removed to the grasses on which there was no fly larva but many aphids. The soil in boxes should be loose and moist to make larva of fly pupation. About 3000-5000 pupae could be obtained in each box. The boxes with pupae should be moved into an empty storehouse before frost and coved properly with a plastic sheet. One or two holes should be made for ventilation. The pupae in the boxes stayed at room temperature during the winter.